VIII. *Caprella.*—Among the numerous specimens sent to me by Dr. Cunningham, all appear to correspond with Dana's description of *C. dilatata*, except one, which more nearly coincides with *C. robusta*—a circumstance that confirms the opinion expressed in the British-Museum 'Catalogue of Amphipodous Crustacea,' that the two species are but sexually distinct. Dana's specimens, like those of Dr. Cunningham, were brought up with the anchor in Rio Harbour.

EXPLANATION OF PLATE XXI.

Fig. 1. *Idotea annulata*, Dana.

Fig. 2. *Galathea monodon*, Milne-Edwards (young), natural size: c, carapace slightly enlarged; *k*, first pair of pereiopoda.

Fig. 3. *Uca Cunninghami*, n. sp., ♀, nat. size: *P*, pleon, seen on the outer side; *P''*, the same, inside, *in situ*, showing:—*p*, pleopoda; v, young crabs; z, termination of intestinal track; *t*, one of the pleopoda.

LI.—*On* Eugereon Boeckingi *and the Genealogy of the Arthropoda.* By Dr. Anton Dohrn*.

The *Eugereon* [described and figured by the author in Dunker's 'Palæontographica,' Bd. xiii.] was found in an iron-stone-pit belonging to M. Boecking, near the Abenteuerhütte, in the district of Birkenfeld. The stone containing it is an argillaceous sphærosiderite, which occurs between the carboniferous formation and the Lower New Red Sandstone, and which also contains a number of known Fishes and the celebrated *Archegosaurus*, together with ligneous fibres as the sole vegetable remains. I have lately received from the same pit an admirably preserved impression of the fore wing of a *Blatta*; so that it is to be hoped that the insect-fauna of former ages will be further enriched from this locality. As early as 1856, however, F. Goldenberg described some insects from the Coal-measures of Saarbrück; and still earlier, in 1842, Germar described several species of *Blattina* from the carboniferous rocks of Wettin. Still older discoveries have been made in North America: Samuel Scudder has described two new Neuropterous forms from the Coal-measures of Illinois, *Miamia* and *Hemeristia*, for both of which he requires the establishment of new families, Palæopterina and Hemeristina,—and also, from the still lower Devonian strata of New Brunswick, wings which he identifies as those of Ephemeridæ, but one of them

* Translated by W. S. Dallas, F.L.S., from the 'Stettiner entomologische Zeitung,' Jahrg. xxviii. (1867) pp. 145–153.

as belonging to an insect which must have been precisely intermediate between the Orthoptera and Neuroptera. By this discovery and that of *Eugereon*, important and hitherto quite unsuspected steps have been made towards the establishment of the genealogical relationship of the order of Insects.

As regards *Eugereon*, in order to indicate the position which, in my opinion, it must occupy in the genealogical tree, I will here reproduce the concluding paragraph of my memoir in the 'Palæontographica.'

"If we compare the organization of the recognizable parts of our fossil with living forms of Insects, we arrive at the surprising result that we have to do with an animal which will not enter into any of our orders of Insects hitherto regarded as so firmly established. Not only M. Tischbein, to whose kind intervention I am indebted for the intellectual possession of the animal, but also Dr. Hagen, of Königsberg, to whom I sent it for his inspection and opinion, regarded it as an Hemipteron, the latter, however, with this limitation:—'Probably it constitutes a perfectly new form, which, on account of the labium, scarcely agrees with the existing Hemiptera, but can only be referred to them.' My own opinion was originally the same; but I am now decidedly of opinion that I have an insect before me to which our divisions do not apply, and which therefore stands outside our system. The wings, especially, prevent my referring it to the Hemiptera. No Hemipteron is destitute of the clavus on the anterior wings; and in none do the longitudinal veins show a tendency to attain the inner margin, but all are directed towards the apex of the wing. Moreover there are no Hemiptera with antennæ resembling those of *Eugereon*. The antennæ of Hemiptera are of several (*i. e.* 4–5) joints, or, if we count all the small intermediate joints (*e. g.* in *Ectrichodia*), of 8–9 joints; but this is the highest number. The form, however, of these joints is essentially different from that of the antennal joints of *Eugereon*. In the Hemiptera they are long, unequal, and here and there furnished with dilatations or other alterations of form; in the latter small and all alike. To this we may add the formation of the buccal organs. The rostrum of the Bugs consists, as is well known, of a nearly closed multiarticulate tube, in which the filiform mandibles and maxillæ are freely moveable. The tube consists of the labium amalgamated with the labial palpi. In *Eugereon* we find all these elements present, but very differently developed. The mandibles and maxillæ are not filiform, nor does the labium form a tube. And yet it is not difficult to regard this structure of the buccal organs as a preliminary step towards the existing Hemipterous

mouth. If we suppose the labial palpi to lay themselves together by their free, smooth, inner margins, and to enclose the jaws within them, we have before us a picture exactly analogous to the rostrum of a Bug. All that would then be necessary is the amalgamation of the two palpi so as to produce the tube, and the gradual conversion of the rather stronger jaws into weaker ones, to attain the formation of the Hemipterous rostrum. The structure of the head, the breadth of the thorax, the form of the legs, which so distinctly remind us of the *Fulgoridæ*, are, moreover, the clearest indications that we have to do with an animal which is very nearly allied to the Hemiptera. On the other hand, however, the form of the wings, the venation, and the antennæ do not altogether negative a comparison with the Neuroptera; and thus we get as the probable final result that *Eugereon* is to be regarded as a very ancient insect, which indicates a still older progenitor, in which Hemiptera and Neuroptera were still entirely undifferentiated. It would be impossible to regard *Eugereon* itself as this progenitor, because, in the first place, Neuroptera were already in existence along with it, their remains having been found; but, on the other hand, we can hardly fail to see how it would gradually entirely lose the characters of the one order and change and bring to perfection the others alone. It is much more intelligible to regard it as part of an extinct side-line, which had a common progenitor with the Hemiptera and Neuroptera, if, indeed, my view as to the relationship of *Eugereon* with the latter order in the structure of the wings and antennæ should prove correct."

Thus, therefore, we have in *Eugereon* an animal which again demonstrates with extraordinary distinctness the truth of the Darwinian theory, and does its part in assisting to throw a little more light upon the principles of morphological science. It was to be expected, and, indeed, was regarded as certain by all unprejudiced naturalists, that morphology in general would undergo a powerful shock and a complete revolution by means of the Darwinian theory, and that a gigantic step would have to be made in this science. Already, before any one could have expected such a thing, this gigantic step has been made by Häckel, the celebrated zoologist of the University of Jena. In his work on the general morphology of organisms* are laid down the principles of a new science, Morphology. I shall have occasion elsewhere to refer fully to the wide significance of this work, and its extremely rich and many-sided contents; here I will only extract one thing, namely, the

* Generelle Morphologie der Organismen, von Ernst Häckel. 2 vols. Berlin, 1866.

genealogical tree of the Arthropoda, which must possess a special interest for the readers of this journal.

Häckel derives the Vermes and Arthropoda from a common root, which stood in genetic connexion with the Infusoria, and from which the Rotatoria have also originated. The Arthropoda then divide into two large sections (*Cladus*):—the *Carides*, Crustacea (Branchiferous Arthropoda); and the *Tracheata*, Insects (Tracheiferous Arthropoda). Häckel very correctly justifies this division by saying that the orders of Arachnida, Myriopoda, and Insecta are more closely connected than certain families of the Crustacea; and it seems pretty certain that the Tracheata were only developed from the Carides. Palæontology, indeed, furnishes but little evidence upon this point; but more is offered by the developmental history of individuals; and it is well known that the larvæ of certain Neuroptera for a long time retain branchial respiration, which they only subsequently exchange for tracheal respiration. As, however, it is to be regarded as an established law that the development of an animal in the egg and in the larval state (the *ontogenetic* development) is only an abridged and partially obscured picture of the development of a genealogical tree (the *phyletic* development), we are justified (as also for many other reasons) in drawing this far-reaching conclusion as to descent from so remarkable a phenomenon as the change in the mode of respiration in the larvæ of Neuroptera. Hence, also, developmental history, the study of which has now been taken up with fresh vigour, acquires an extraordinary importance; and it is to be hoped that the necessary aid will not be denied on the part of entomologists: and this will consist essentially in their undertaking a description and systematization of the larvæ as well as the description and classification of the perfectly developed insects, and in ascertaining by observation the external changes which the body of the larva undergoes until it becomes transformed into the perfect insect.

I will not enter into the details of the development and descent of the Crustacea, but only refer to the hypothetical order of the *Zoëpoda*, which, according to the concordant opinions of Fritz Müller and Häckel, included the progenitors of the Schizopoda (*Mysis*, *Euphausia*), and consequently of the Stomatopoda, Decapoda, and all the Edriophthalma originating from these, as also of the Tracheata. The assumption of this order is founded upon the *Zoëa*, so well known to all crustaceologists, a developmental form in the ontogenesis of most Podophthalma, which refers us back to the Zoëpoda. The unknown common original form of the Arachnida, Myrio-

poda, and Insecta must have been a Zoëpod, which accustomed itself to living on the land and to direct aërial respiration, and thus gradually, in the course of a long series of generations, acquired the very characteristic tracheal respiration. It must have been developed in the time between the Silurian and Carboniferous periods; for in the Silurian period there were as yet (at least so far as we know at present) no terrestrial organisms, but in the Carboniferous period, and even in the Devonian (according to the most recent publications of S. Scudder), the earliest developed Tracheata, both Insects and Arachnida, had already made their appearance.

The primitive forms of the three sections Arachnida, Myriopoda, and Insecta, as to which we can now only form analogical conclusions, are named *Protracheata* (*Urkerfe*, Primitive Insects) by Häckel, who characterizes them as follows:—"Of these primitive forms of the Tracheata, developed from the Zoëpoda between the Silurian and Carboniferous periods, no fossil remains are known to us. Nevertheless the comparative ontogeny of the Malacostraca, Arachnida, Myriopoda, and Insecta enables us to arrive, with tolerable certainty, at definite conclusions as to their form. Like many Zoëpoda (which are still preserved to us in *Zoëa*-states) and like the true insects, between which they occupy an intermediate position, the Protracheata, as the type of which we may establish the hypothetical genus *Zoentomon*, must have possessed three pairs of jaws and three pairs of locomotive extremities. From these hexapod Zoentomidæ, in all probability, the Insecta have been developed as the direct branch, and the Arachnida as a weaker lateral branch. The Myriopoda constitute only an inconsiderable lateral branchlet of the Insecta. Whether any Protracheata are still in existence is doubtful. The *Solifugæ* might, perhaps, be placed in this category, and perhaps also those 'apterous insects' (if there be any such among existing insects) in which the want of wings is *aboriginal*, and has not been *acquired* by adaptation."

The Arachnida I likewise leave out of the question here, and will only mention the one highly remarkable form which alone in this class has still retained the old type, and which allows us to arrive at a certain conclusion as to the original community of ancestry of the Insecta and Arachnida—that of the *Solifugæ*. In this family we find no amalgamation of the head and thoracic segments to form a cephalothorax, but three perfectly separated regions of the body—head, thorax, and abdomen. The head bears the pair of eyes, the pair of antennæ, and two pairs of maxillary palpi. The three segments of the thorax bear the three pairs of true legs. The abdomen,

which is destitute of appendages, is composed of ten segments. By the fusion of the head and three thoracic segments we get the primary form of the *Arthrogastres* (Scorpions, &c.), and by the further fusion of the abdominal segments into one piece the *Sphærogastres* (true Spiders).

The Myriopoda have broken out from some early insectan branch. This is clearly shown by their embryonal form and development; for the embryos possess only three pairs of legs, and perfectly resemble larvæ of insects. Moreover the internal anatomy of the Myriopoda is so nearly related to that of insects that there can be no doubt of the fact of their derivation. The great number of body-segments, and consequently of legs, is a subsequent addition, acquired after the branching off, as is proved by their development, and is also shown by the analogy of many Crustacea (Edriophthalma).

Thus we come to the true Insecta. Here, following the example of Fritz Müller and Häckel, we must in the first place dispose of a strong prejudice, namely, the principle of classification according to the "complete" or "incomplete" metamorphosis. This is now-a-days a perfectly untenable principle. We now know not only what is the significance of metamorphosis in general and what we are to conclude therefrom, but we have also learnt, thanks to the brilliant investigations of Fritz Müller upon the Crustacea, what modalities may affect the metamorphosis, lengthening, abridging, or altering it; and we know that the so-called "perfect" metamorphosis of many, and perhaps of all insects, has been *acquired* during ontogenesis (and not *inherited* from the original progenitor). Moreover we have obtained from the facts the abstraction that the metamorphosis is always abridged in proportion as more generations follow one another, and that the tendency of the organisms (if we may use the expression) is always striving to attain, by the shortest possible way, from the egg state to the perfect, sexually mature animal. For this reason I have already indicated how important, and how rich in unexpected results, a comparative investigation of larvæ will be. One of the most striking examples of a perfect difference of metamorphosis, with the greatest similarity in its starting and finishing points (the egg and the sexually mature animal), is presented by a species of the genus *Gecarcinus*, a Brachyurous Crustacean which, like the Crayfish, quits the egg at once in its definitive form, whilst all other crabs, and even all other species of the genus *Gecarcinus*, only attain their definitive form after passing through a metamorphosis. Similar peculiarities will certainly be presented to us by a careful investigation of larvæ, and the notions of complete and

incomplete metamorphosis will not hold their ground against a sharper examination and criticism of the facts.

Häckel has also entirely given up this principle of division, and retained instead of it the form of the buccal organs, so far as they are arranged either for biting or sucking. Whether this is a permanent principle must be shown hereafter, when more means of observation may be employed than at present. Discoveries like *Eugereon*, in a palæontological direction, and the larva of *Sisyra* (described by Westwood as *Branchiotoma Spongillæ*, see Gerstäcker and Carus, 'Zoologie,' p. 73), which, as I have been informed by Professor Grube, and also find repeated in Gerstäcker's 'Handbuch,' likewise has a sucking buccal apparatus, although its imago belongs to the Neuroptera, are certainly adapted to render the certainty of this mode of division somewhat doubtful. However, it is of no consequence whether or not there is such a principle of division; when we have a knowledge of the ontogenetic and phylogenetic development we can subsequently select any principle we like, and employ it for the sake of convenience. For the present we must adhere to Häckel's classification. Häckel is of opinion that the first Protracheate (belonging to the hypothetically adopted family produced from the Zoëpoda, but which still united in itself the germs of the Insecta, Arachnida, and Myriopoda), which possessed two developed pairs of wings, is to be regarded as the common progenitor of all the living and fossil insects known to us, as the apterous forms undoubtedly all (?) originate from winged ancestors, and have lost their wings by adaptation and secondary generation. The development of this progenitor falls in the interval between the Silurian and Carboniferous periods, and probably in the ante-Devonian period; for we have insects from the Devonian as well as from the coal, and these are exclusively *Masticantia* (Orthoptera, Neuroptera, Coleoptera). These Häckel regards as the oldest insects, in opposition to the *Sugentia*, which have branched off from the *Masticantia*; and this is certainly probable when we glance at the ontogenesis of the former. The *Masticantia* he divides into three orders:—*Toroptera*, *Coleoptera*, and *Hymenoptera*. The Toroptera are the scarcest, and combine the *Pseudo-Neuroptera*, *Neuroptera*, and *Orthoptera*, which are very nearly allied to each other in many respects, and were formerly only separated by the metamorphosis. As, however, the systematic value of the metamorphosis, as a means of division, has been diminished, these former orders are certainly justly united. Häckel thinks that the Orthoptera and Neuroptera have been developed from the Pseudo-Neuroptera—an opinion which obtains a foundation of

fact by the discovery, in the Devonian strata of New Brunswick already mentioned, of an organism uniting the characters of both orders. With regard to the Coleoptera, he assumes that they were developed from the Orthoptera, and the Hymenoptera from the Neuroptera or Pseudo-Neuroptera.

The *Sugentia*, again, include three divisions:—*Hemiptera*, *Diptera*, and *Lepidoptera*. All these, Häckel supposes, originated from the Toroptera later than the Coleoptera and Hymenoptera, as their first palæontological traces are derived only from the Jurassic strata. The knowledge of *Eugereon*, however, on the other hand, makes him think it not improbable that the Hemiptera diverged from the Toroptera as early as the Primary periods. The origin of the Diptera and Lepidoptera he leaves in doubt, as, in consequence of the segregation (*Abgeschlossenheit*) of these two orders, no conclusions can be derived from probabilities about them.

With this I conclude my report upon this part of Häckel's remarkable book. I hope soon to be able to make some communications upon special embryological investigations and their general results, as this department is now being worked on several hands with particular predilection. At any rate, however, the satisfactory fact is to be proved that entomology, as well as morphology in general, has acquired a new and fruitful impulse from the Darwinian reform, and that it will be the fault of entomologists themselves if they do not assist in the construction of the new road.

LII.—*On some additional Species of the Genus* Eutoxeres.

By J. Gould, F.R.S. &c.

I have for some time past had reason to believe that the Humming-birds of this highly singular form comprised more species than the two already described (*Eutoxeres aquila* and *E. Condamini*); but it is only of late that I have acquired sufficient materials to justify my arriving at any satisfactory conclusion on the subject. At this moment I have before me three specimens of the true *E. aquila* from New Granada, seven skins of a bird from the neighbourhood of Quito, which I consider to be distinct from that species, and three from Veragua, which differ slightly from both.

E. aquila is the largest species of the genus, and is distinguished by the snow-white shafts of its tail-feathers, which doubtless show very conspicuously when the bird is on the wing and the tail widely spread; this character is found in every specimen I have examined, and, I believe, will prove